

EXERCISES

For more practice, see *Extra Practice*.

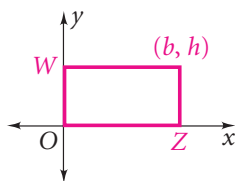
Practice and Problem Solving

A Practice by Example

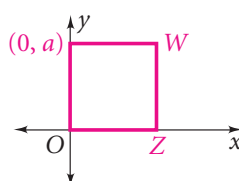
Example 1
(page 326)

Give coordinates for points W and Z without using any new variables.

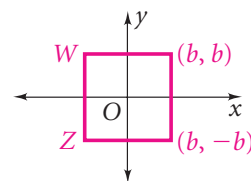
1. rectangle



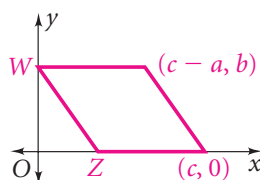
2. square



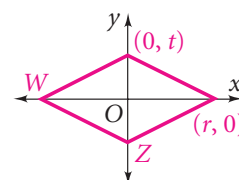
3. square



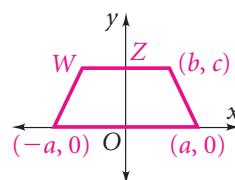
4. parallelogram



5. rhombus



6. isosceles trapezoid



Example 2
(page 327)

In each exercise, find the coordinates of the midpoint of \overline{WZ} and the slope of \overline{WZ} .

7. Exercise 1

8. Exercise 2

9. Exercise 3

10. Exercise 4

11. Exercise 5

12. Exercise 6

13. **Developing Proof** Complete the steps to show that the midpoint of the hypotenuse of a right triangle is equidistant from the vertices of the triangle.

Given: Right $\triangle ABC$ with M the midpoint of hypotenuse \overline{AB}

Prove: $MA = MB = MC$

Step 1: Draw right $\triangle ABC$ on a coordinate plane. Locate the right angle, $\angle C$, at the origin and leg \overline{CA} on the positive x -axis.

Step 2: You seek a midpoint, so label coordinates using multiples of 2. The coordinates of point A are **a.** $\underline{\hspace{1cm}}$. The coordinates of point B are **b.** $\underline{\hspace{1cm}}$.

Step 3: By the Midpoint Formula, the coordinates of midpoint M are **c.** $\underline{\hspace{1cm}}$.

Step 4: By the Distance Formula, $MA =$ **d.** $\underline{\hspace{1cm}}$, $MB =$ **e.** $\underline{\hspace{1cm}}$, and $MC =$ **f.** $\underline{\hspace{1cm}}$.

Step 5: Conclusion: **g.** $\underline{\hspace{1cm}}$

B Apply Your Skills

Here are coordinates for eight points in the coordinate plane ($q > p > 0$).

$A(0, 0)$, $B(p, 0)$, $C(q, 0)$, $D(p + q, 0)$, $E(0, q)$, $F(p, q)$, $G(q, q)$, $H(p + q, q)$

Which four points, if any, are the vertices for each type of figure?

14. parallelogram

15. rhombus

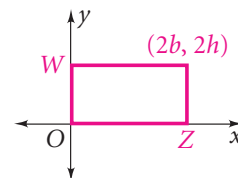
16. rectangle

17. square

18. trapezoid

19. isosceles trapezoid

Refer to the diagrams in Exercises 1–6. Use the coordinates given below in place of the ones shown. Then give the coordinates for points W and Z without using any new variables. The new diagram for Exercise 20 is shown here.



20. Ex. 1, $(2b, 2h)$

21. Ex. 2, $(0, 2a)$

22. Ex. 3, $(2b, 2b)$, $(2b, -2b)$

23. Ex. 4, $(2c, 0)$, $(2c - 2a, b)$

24. Ex. 5, $(2r, 0)$, $(0, 2t)$

25. Ex. 6, $(-2a, 0)$, $(2a, 0)$, $(2b, 2c)$

26. **a.** What property of a rhombus makes it convenient to place its diagonals on the x - and y -axes?
b. Writing Suppose a parallelogram is not a rhombus. Explain why it may not be convenient to place opposite vertices on the y -axis.
27. **Open-Ended** Choose values for r and t in Exercise 5. Find the slope and length of each side. State why the figure satisfies the definition of a rhombus.

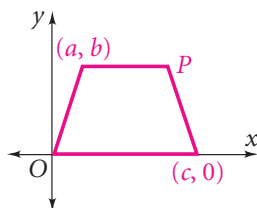


Need Help?

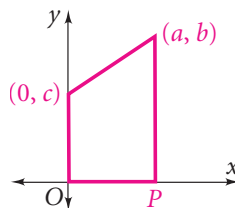
In Exercise 28, draw a vertical line from P to the x -axis and a horizontal line from P to the y -axis.

Give the coordinates for point P without using any new variables.

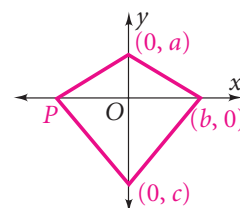
28. isosceles trapezoid



29. trapezoid with a right \angle



30. kite



31. **a.** Draw a square whose diagonals of length $2b$ lie on the x - and y -axes.
b. Give the coordinates of the vertices of the square.
c. Compute the length of a side of the square.
d. Find the slopes of two adjacent sides of the square.
e. Do the slopes show that the sides are perpendicular? Explain.
32. Make two drawings of an isosceles triangle with base length $2b$ and height $2c$.
a. In one drawing, place the base on the x -axis with a vertex at the origin.
b. In the second, place the base on the x -axis with its midpoint at the origin.
c. Find the lengths of the legs of the triangle as placed in part (a).
d. Find the lengths of the legs of the triangle as placed in part (b).
e. How do the results of parts (c) and (d) compare?



Challenge



33. **Marine Archaeology** Marine archaeologists sometimes use a coordinate system on the ocean floor. They record the coordinates of points where artifacts are found. Assume that each diver searches a square area and can go no farther than b units from the starting points. Draw a model for the region one diver can search. Assign coordinates to the vertices without using any new variables.



34. **Coordinate Proof** Follow the steps below to prove:

If two nonvertical lines are perpendicular, the product of their slopes is -1 .

Step 1: Two nonvertical lines, ℓ_1 and ℓ_2 , intersect. Which coordinate point might be the easiest to work with as the point of intersection?

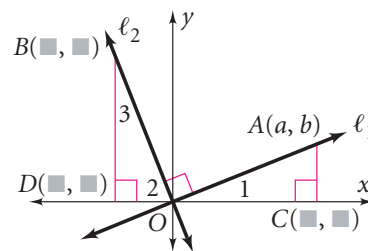
Step 2: To work with the slope of a line, you need two points on the line. Choose one point $A(a, b)$ on ℓ_1 . What are the coordinates of C ?

Step 3: Notice that $\angle 1$ and $\angle 3$ are both complements of $\angle 2$. Why?

Step 4: This means that the two triangles pictured have congruent angles. Thus, if any pair of sides are congruent, the two triangles are congruent. Congruent triangles are desirable, so what would be a good choice for the coordinates of point D ?

Step 5: If you made a choice for D so that $\triangle ACO \cong \triangle ODB$ what must be the coordinates of point B ?

Step 6: Now, complete the proof that the product of slopes is -1 .





Standardized Test Prep

Multiple Choice

35. The vertices of a rhombus are located at $(a, 0)$, $(0, b)$, $(-a, 0)$, and $(0, -b)$, where $a, b > 0$. What is the midpoint of the side that is in Quadrant II?
- A. $(\frac{a}{2}, \frac{b}{2})$ B. $(-\frac{a}{2}, \frac{b}{2})$ C. $(-\frac{a}{2}, -\frac{b}{2})$ D. $(\frac{a}{2}, -\frac{b}{2})$
36. The vertices of a kite are located at $(0, a)$, $(b, 0)$, $(0, -c)$, and $(-b, 0)$, where $a, b, c, d > 0$. What is the slope of the side in Quadrant IV?
- F. $\frac{c}{b}$ G. $\frac{b}{c}$ H. $-\frac{b}{c}$ I. $-\frac{c}{b}$
37. The vertices of a square are located at $(a, 0)$, (a, a) , $(0, a)$, and $(0, 0)$. What is the length of a diagonal?
- A. a B. $2a$ C. $a\sqrt{2}$ D. $2\sqrt{a}$

Quantitative Comparison

Compare the boxed quantity in Column A with the boxed quantity in Column B. Choose the best answer.

- A. The quantity in Column A is greater.
 B. The quantity in Column B is greater.
 C. The two quantities are equal.
 D. The relationship cannot be determined from the information given.

The points $A(p, p + 2)$, $B(r, s)$, and $C(3p, 3p)$ are collinear, and $p \neq 0$.
 B is the midpoint of \overline{AC} .

Column A

Column B

38.

r

$2p$

39.

s

$2p$

40.

the slope of \overline{AC}

$1 - \frac{1}{p}$



Take It to the NET

Online lesson quiz at
www.PHSchool.com
 Web Code: afa-0606

Short Response

41. The vertices of a rectangle are $(2b, 0)$, $(2b, 2a)$, $(0, 2a)$, and $(0, 0)$. What are the coordinates of the midpoint of each diagonal? What can you conclude from your answers?

Mixed Review

Lesson 6-5

42. Find the measure of each angle and the value of x in the isosceles trapezoid at the right.



Lesson 5-3

- Find the center of the circle that circumscribes $\triangle ABC$.

43. $A(1, 1)$, $B(5, 3)$, $C(5, 1)$

44. $A(-5, 0)$, $B(-1, -8)$, $C(-1, 0)$

Lesson 4-3

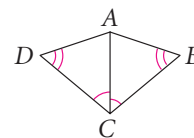
45. Supply the words that complete the paragraph proof.

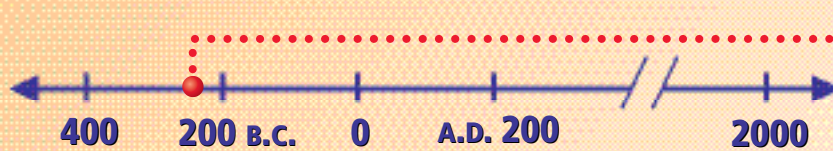
Given: $\angle ACD \cong \angle ACB$ and $\angle D \cong \angle B$

Prove: $\triangle ADC \cong \triangle ABC$

$\angle ACD \cong \angle ACB$ and $\angle D \cong \angle B$. $\overline{AC} \cong \overline{AC}$ by the

a. ? Property of Congruence. So, $\triangle ADC \cong \triangle ABC$ by the b. ? Theorem.





A Point in Time



Many walls in ancient Egypt were decorated with reliefs. The relief in the photo was created in the year 255 B.C. First, the artist sketched the scene on papyrus overlaid with a grid. Next, the wall was marked with a grid the size of the intended sculpture. To draw each line, a tightly stretched string that had been dipped in red ochre was plucked, like a guitar string.

Using the grid squares as guides, the artist transferred the drawing to the wall. Then, a sculptor cut the background away, leaving the scene slightly raised. Finally, an artist painted the scene.



Take It to the NET For more information about Egyptian reliefs, go to **www.PHSchool.com**.

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